An Exploratory Study on Sustainable Supply Chain Management in Indian MSMEs

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1. Introduction

Supply Chain Management (SCM) as a concept has come into limelight from the last two decades. It was used to control the logistics among businesses (Womack and Jones, 1994). There are several reasons for this concept to become popular. Over time, businesses have begun to source globally. This requires an effective coordination for the flow of materials within and outside the company which necessitates a long-term partnership with the suppliers. Further, to remain competitive, it is pre-requisite for the suppliers to include cutting-edge quality management techniques as well as consider the time factor during manufacturing. Customers demand for products which are reliable, defect-free and delivered on time. Apart from this, products that have the ability to remain in the market despite the performance based competition and global orientation accounts to competitive advantage of a company. In order to address this market uncertainty, it is important to enhance the flexibility of the supply chains (SC) (Mentzer et al., 2001). SCM concept is characterized by (a) arrangement of suppliers; (b) network for the effective flow of materials; (c) philosophy for running businesses; and (d) collaboration strategies for competitive advantage (Chandra and Kumar, 2001). Later on, there was a need for dealing with several situations in the real life, and research on SCM made a gradual shift towards a more developed and integrated approach, rather than a single objective of cost reduction or profit maximization. It was observed that, long-term success of an enterprise is guaranteed by incorporating resilience into its SC (Hart, 1995). Sustainable development was integrated with SCM to address these challenges faced by the businesses. In the year 1987, sustainable development was first introduced to the world by the Brundtland report. This dates back to the year 1983, when the World Commission on Environment and Development (WCED) organized by the United Nations was formed for the environmental protection and preservation of natural resources, this report, initially called as “Our Common Future” was prepared. Later on, it was named as the Brundtland Report in acknowledgment to the chairman of the WCED, Gro Harlem Brundtland. This report identified the concept of sustainable development, which focussed on meeting the needs at present without forgetting our responsibility to preserve resources for future. In simple terms, this generation requires certain amount of resources to meet their own needs. Moreover, it is necessary to sustain these resources or develop new ones for the future generation. However, balancing these tasks is extremely critical, as it is a prediction of the future with an uncertain outcome.

Researchers have proposed several measures to enable the shift towards environmentally responsible manufacturing like green product design, which aims to enhance the product compatibility with the environment without negotiating on the functional or quality aspect (Navinchandra, 1990). Later on, it was suggested that green products be also designed in a manner so as to also enhance the manufacturers' competitive advantage (Pujari, 2006) thereby, enhancing both the ecological as well as economic performance (Zhu et al., 2007). Policy makers both external and internal, play a major role in promoting strategies that lead to pollution prevention and environmental and societal conservation. The alarming levels of pollution have pressurized manufacturing enterprises to develop and promote sustainable products (Seuring, 2013; Seuring & Müller, 2008). A few nations use legislation and fine impositions to increase knowledge among manufacturers who contribute to environmental pollution (Robeson, 1994; Sheu & Chen, 2012). There are two suitable approaches to address the environmental degradation which are employed by the governments worldwide, i.e. cap-and-trade and pollution taxation mechanisms.

All the three dimensions of sustainability, with equal weightage, have not been addressed in one study (Seuring, 2013; Seuring and Muller, 2008), however, authors have expressed their concerns that in SCs, the social, environmental, and economic perspectives of the Triple Bottom Line (TBL) are linked to each other which have common drivers, enablers, and barriers (Hassini et al., 2012; Touboulic & Walker, 2015). Nonetheless, the relevance of one perspective could be industry specific. Several operations research tools were considered to be a suitable means for envisaging and solving the environmental issues in the SCs. Thus, during the 2000s, sustainable operations management was conceptualised that addressed the various environmental as well as social issues along with economic aspects of SCs into a common frame (Seuring and Müller, 2008). Furthermore, with perennial industrial expansion, there was an immediate need for a shift from the conventional SCM to the sustainable SCM. Sustainable supply chain management (SSCM) was first projected by Linton in 2007 (Linton et al., 2007). The foundation of the present research is based on the classical work on SSCM by Ahi and Searcy, who defined the SSCM as follows (Ahi and Searcy, 2013):

> *"Sustainable supply chain management is voluntary integration of social, economic, and environmental, considerations with key inter-organizational business systems to create a coordinated supply chain to effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services to fulfil short term and long*

term profitability, stakeholder requirements, competitiveness and resilience of the organisation."

The next section describes the overview of the research work and also organisation of thesis.

1.1 Overview of research and organisation of thesis

This research work begins with first chapter introducing the broad area of SCM and further explains the need for diving into the sustainability of the SCs. This chapter also explains the need for research in the MSMEs and also justifies the need for sustainability of SCs in the automobile component manufacturing, MSMEs in particular. The research objectives have also been described briefly in this chapter.

Chapter 2 is dedicated to the first research objective and includes an in depth literature review on the area of SSCM for which research articles, company reports, and related books have been referred thoroughly. The major focus has been on classification of the existing literature on SSCM into five broad perspectives of environmental, social, economic, performance and governance. A set of unique managerial implications have also been summarized in this chapter. The chapter also highlights the existing research gaps in the area of SSCM which led to finalizing the research objectives of this study.

Chapter 3 is dedicated to the second research objective which includes the identification of implementation inhibitors to the adoption of SSCPs in the Indian automobile component manufacturing MSMEs. A quantitative modelling approach has been adopted for these implementation inhibitors to prioritize the same. The multi-criteria decision making tool, Analytic Hierarchy process (AHP), has been applied for this purpose. A sensitivity analysis has also been conducted to ensure post optimality in the obtained results.

Chapter 4 is dedicated to the third research objective which includes the mapping of the critical dimensions and success factors which aid in the implementation of SSCPs. The interrelationships among the mapped critical dimensions and success factors have been derived. Thus, a quantitative modelling approach has been adopted which addresses the linkages among those factors. The Analytic Network process (ANP) has been utilized here. In

furtherance to this, Fuzzy Logic modelling approach was applied to the obtained results with the aim to reduce the subjective bias involved in decision making in case of ANP.

Chapter 5 is dedicated to the fourth objective which involves the identification of key performance indicators with respect to the implementation of SSCPs in the Indian MSMEs. A hybrid structural modelling approach was utilised for this study to understand the interaction and importance of the performance indicators. The tool used for this work was Total Weighted Interpretive Structural Modelling (TWISM) followed by AHP

Chapter 6 includes the summary, highlights and research insights of all the research objectives identified and discussed in this study. It also includes a few conceptual frameworks based on the author's understanding of the topic. The thesis has been organised in the manner mentioned above.

The next section provides brief overview of the literature review conducted in the research. The chapter 2 in the thesis contains a detailed description of all the perspectives of SSCM highlighted in the literature.

2. Review of Literature

Sustainable Supply Chain Management has emerged from the identification of the strategic importance of purchasing and supply decisions to attain the organization's long-term performance, and address the sustainability issues. The top five SC issues and challenges include – visibility, cost minimisation, risk management, meeting customer demands and globalisation. The economic cycle of growth, recovery and flexibility affect the effectiveness of the SCs (Tseng et al., 2019). There are a number of demand side issues as well as supply side issues inherent to the automobile SCs. Uneven growth, fragmented structure, volatile market scenario and the aftermarket opportunities are some of the demand side issues. The supply side issues include distinctive outsourcing, purchasing from countries offering reduced costs, risk management approaches and requirement of business transparency (Chen et al., 2019). There is a fierce competition among the Indian automobile industries. Short product lifecycles, strict operating margins, ever-increasing customer expectations are making it difficult for the smaller units to sustain this pressure. The continuous improvement through innovations in transportation and communication sector like GPS, mobile phones,

internet services and other applications necessitates an organised SCM in the automobile sector. There is an increase in the number of companies in the automobile sector which forces each other to reduce their prices thereby affecting their profitability. This further calls for the implementation of effective SCM practices in this sector.

Micro, small and medium enterprises (MSMEs) lack the ability to compete with the global industries when it comes to attaining the sustainability goals (Dubey et al., 2015). It is important to identify the barriers or enablers hindering or leveraging the adoption of sustainable supply chain practices (SSCPs) in the MSMEs of developing nations to sustain the global competitive culture owing to liberalisation. Also, globalisation has forced Indian MSMEs to continuously cut down the prices while compromising on quality and services (Kumar et al., 2014; Gupta & Barua, 2015; Gupta & Nanda, 2015). Over time, authors have suggested that MSMEs which aim for a sustainable growth must orient their manufacturing as well as business strategies to accommodate the resources available, dynamic nature of markets and customers' expectations etc. (Porter, 1998; Alam & Dunan, 2019).

SSCM researchers need to understand the risk arising out of the lack of a conceptual foundation in SSCM which can otherwise become a legitimate management discipline (Carter, 2011). The descriptive nature of current SSCM research has been elaborated which is useful in gathering knowledge on facts, however, these are unable to significantly contribute to the SSCM theories and that is why this field was considered to be conceptually immature and underdeveloped having a lot of scope for further research (Hoejmose and Adrien-Kirby, 2012). There are broadly three different perspectives of SSCM that have been addressed by researchers over time, such as, environmental perspective, social perspective and economic perspective. This study has attempted to classify the available literature by including two more perspectives, i.e. the performance measurement perspective and governance perspective. The various perspectives of SSCM have been categorically represented in Figure 1.

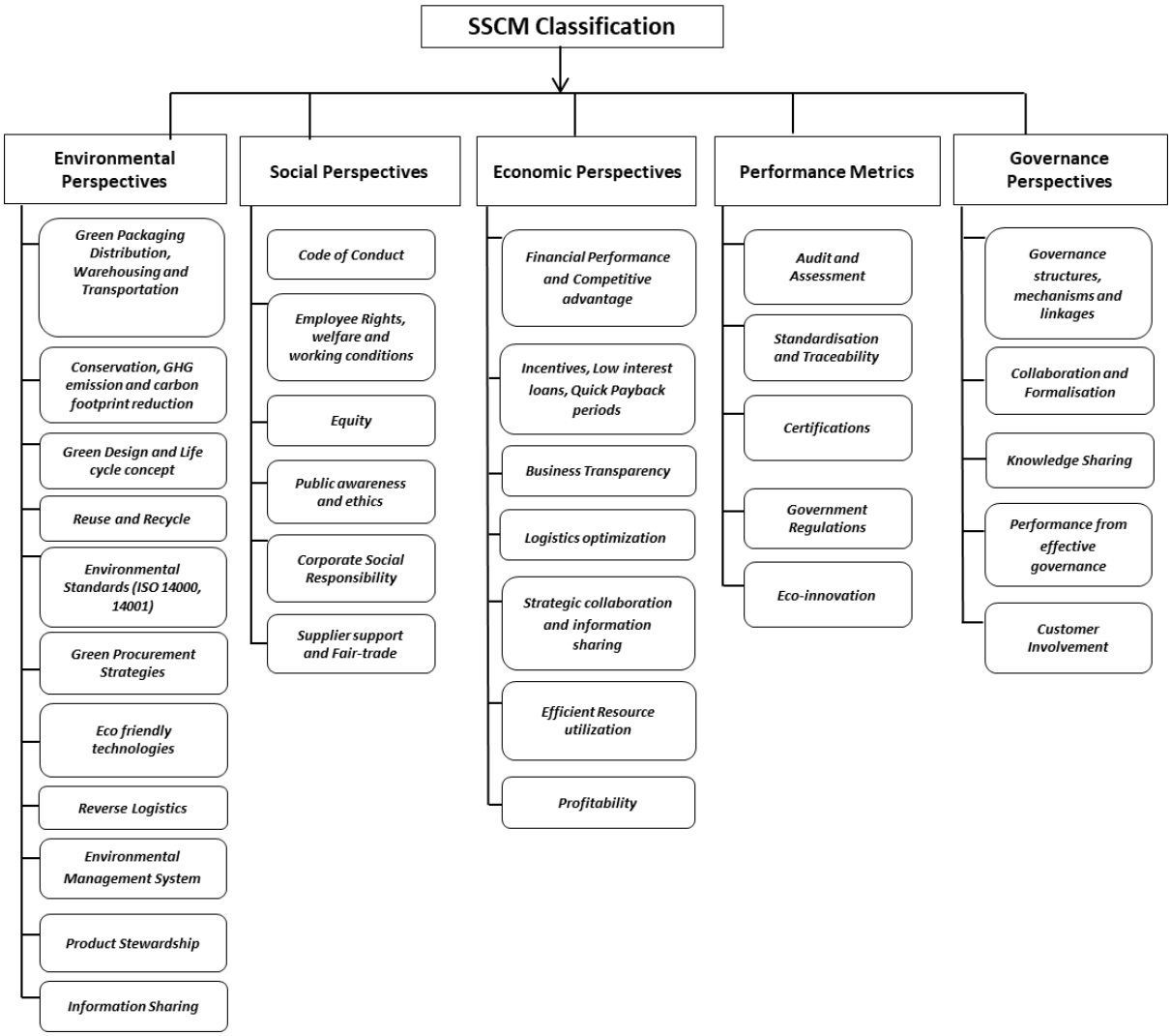

Figure 1. Classification of SSCM literature

The next sub-section provides the general observations obtained while conducting the review of literature on the field of SSCM.

2.1 General observations from literature on SSCM of Indian MSMEs

A focused review of literature generated a number of potential research avenues in the area of SSCM. These gaps are summarized below which would lead to a number of research directions for the future.

- The integration of social issues into the environmental and economic aspect of SSCM.
- Lifecycle analysis and the principles of closed loop SCs for an integrated view of sustainability in SCs.

- Addressing the issues of inventory management within sustainable supply chains (SSCs) (as the traditional inventory models only consider the economic perspectives).
- Collaborative relationships between suppliers and customers for better understanding and implementation of SSC initiatives and practices.
- Linkage between sustainability initiatives and managerial practices for success or failure of SSC practices.
- Guidelines, evaluation tools, performance indicators and techniques for MSMEs and large enterprises to justify investment for SSC practices.
- Industry specific research on SSCM.

These distinctive features together would place SCM within the purview of the overall research area on sustainability.

This study has identified a few critical gaps which have led to research questions enumerated as follows.

a) How can we identify the critical barriers and their relative importance which hinder the successful implementation of sustainable operational and SC practices in MSMEs?
b) How can we determine the relative position of an enterprise in terms of the implementation of SSCPs in MSMEs by determining an index?
c) What are the SSC performance indicators that help in measuring the performance of enterprises?

The next sub-section highlights the three research objectives of the present work.

2.2 Research Objectives

Until recently, the primary objective of all businesses was to minimize cost and maximize profits. However, the shift towards sustainability in the present scenario gained popularity among small, medium to large scale multinational enterprises. Since, the SCs are complex in nature, it is a challenging task to bring about SC sustainability. SCs have a direct impact on the overall well-being of the people and the planet. Long term benefits in terms of cost, environmental conservation and societal well-being are associated with the SCs becoming sustainable. With the mounting pressure from the regulators, the suppliers, the customers and the employees of an enterprise to attain sustainability forces the enterprise to provide evidence about their compliance towards sustainability. Thus, research in the field of SSCM

is extremely necessary as it would help the policy makers, the top management, the government, and the customers to understand its scope and adopt suitable measures to transform this concept into reality.

The identification and integration of the key business processes to deliver products, services and information to add value by the collaborative initiatives by the SC factors is inherent to SSCM. It is also essential to implement SSCPs to maintain a healthy society without ignoring the performance standards and governance, while meeting the environmental, economic, and social goals.

The present study aims at addressing three research objectives. The objectives along with their scope have been elaborated as follows:

- RO1: Developing a quantitative framework for implementation of SSCPs in Indian MSMEs by identifying the critical implementation inhibitors.
- RO2: Developing a quantitative framework to assess the degree of implementation of the SSCPs to enhance the chances of MSMEs as a potential candidate for long term relationship with original equipment manufacturers (OEMs).
- RO3: Developing an integrated structural framework for assessing performance indicators for the implementation of SSCPs in Indian MSMEs.

The following section provides an overview of the research methodology adopted in the addressing the research objectives identified in the study.

3. Research Methodology

The focus of the current research is to develop a roadmap for implementation of SSCM practices in Indian MSMEs. For this, various perspectives are needed to be considered from the published literature, company reports and expert opinions both from industry and academia through quantitative modelling and decision making. The flow of this research work has been depicted in Figure 2.

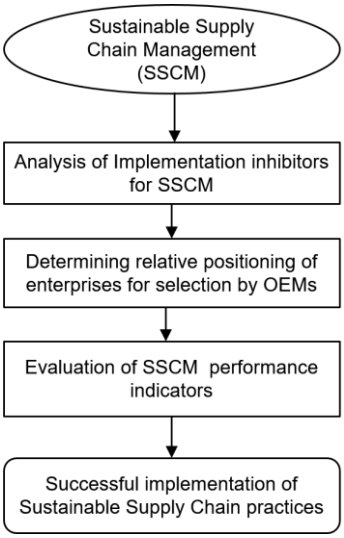
Sustainable Supply Chain Management (SSCM)
Analysis of Implementation inhibitors for SSCM
Determining relative positioning of enterprises for selection by OEMs
Evaluation of SSCM performance indicators
Successful implementation of Sustainable Supply Chain practices

Figure 2. Overall research flow diagram

In the third chapter, a quantitative modelling technique has been adopted which is validated through a case study. The multi-criteria decision making tool used for this work is, Analytic Hierarchy Process. A focus group has been selected from automobile component manufacturing enterprises for the study which comprised of a panel of experts from industry and academia with relevant expertise and experience on SSCM and its implementation. Expert opinions were considered for determining the relative importance of the implementation inhibitors identified from the study. A sensitivity analysis has also been performed for post optimality.

In the fourth chapter, a quantitative modelling approach with a hybrid methodology has been adopted which includes a multi-criteria decision making tool like Analytic Network Process and Fuzzy Logic. This technique was also validated through a case study. A focus group was selected from automobile component manufacturing enterprises with a panel of experts basing out of industry and academia. A list of critical dimensions and success factors for the implementation of SSCPs were identified. The subjective judgements from the group of experts helped in conducting an ‘adaptability test’ for MSMEs to become potential partners to OEMs.

In the fifth chapter, a hybrid methodology consisting of a structural modelling approach called Total Weighted Interpretive Structural Modelling and multi-criteria decision making tool, Analytic Hierarchy Process has been adopted. The study was validated though a case study. A focus group was selected from automobile component manufacturing enterprises for this research comprising of academic as well as industrial experts having relevant experience

in the field of SSCM. The key performance indicators which have a direct bearing on the implementation of SSCPs have been identified through the study. The mutual interactions of the indicators along with their relative importance has been analysed in this study.

3.1 Quantitative models in research work

There are three quantitative models involved in this research work which have been summarized in the Table 1.

Table 3. Quantitative models in the research

Model Number	Model Description	Tool used
1	Quantitative modelling with MCDM to identify the critical implementation inhibitors for sustainable supply chain management	Analytic hierarchy process
2	Quantitative hybrid model for multi-criteria decision making to establish the adaptability of MSMEs to develop a strategic relationship with the OEMs.	Analytic network process followed by fuzzy logic
3	Structural modelling with multi-criteria decision making to determine the performance indicators for the implementation of the sustainable supply chain practices in the MSMEs	Total weighted interpretive structural modelling followed by analytic hierarchy process

The expected outcomes of the proposed research are enumerated as below:

1) A classification and mapping of the existing theories and perspectives for the implementation of SSCM practices.

2) Identification of a set of critical inhibitors that hinder the implementation of SSCPs in business enterprises.

3) Identification of a set of critical success factors which will guide the enterprises to implement the SSCPs.

4) The measurement of the degree of implementation of SSCPs in the business enterprises which would determine the relative position of these enterprises.

5) A set of key performance indicators to evaluate the implementation of SSCPs in case enterprises.

The next section provides a brief description of the results and discussions from all the three research objectives in the thesis.

4. Results and Discussions

The thesis has three research objectives which have been presented as Chapters 3, 4 and 5 respectively. In Chapter 3, it has been observed that the lack of sustainability policies and appropriate regulations (SPR) and misalignment of short-term and long-term strategy goals (SLS) constitute the critical inhibiting criteria for implementation of sustainable supply chain practices (SSCP) in Indian SMEs. It is imperative from the results that a robust sustainability policy and government regulations, as well as the alignment of the short-term and long-term strategy goals, are at the core of the sustainable development of the select Indian SMEs. These are the top priority pre-requisites for these enterprises to improve their position in terms of the sustainability initiatives. The lack of structured resource management approaches (SRM) criteria and the lack of supply chain orientation (SCO) criteria constitute the other critical attributes impacting the implementation of SSCPs. This reveals that the importance of the implementation of structured resource management systems and the supply chain orientation cannot be ignored from the perspective of the sustainable supply chain performance. At the micro level (sub-criteria level), it has been observed that the lack of stringent government rules and regulations (GR) is the most critical inhibitor for the implementation of SSCP in Indian SMEs followed by lack of corporate strategy and management support (CS) and lack of environmental policy and implementation framework (EP). The challenges posed by these implementation inhibitors need to be addressed by the Indian SMEs.

The fourth chapter provides a relative Sustainable Supply Intensity Index (RSSII) which has a direct bearing on the MSMEs to be selected as potential partners by OEMs. If an MSME receives a RSSII below 47.35%, it implies that it has implemented low intensity sustainability practices (LISP). The OEMs must never consider this enterprise for long-term partnership. If the RSSII falls between 47.35% and 89.45%, the enterprise has implemented average intensity sustainability practices (AISP). Such MSMEs may be considered for strategic partnership after further assessment. If an MSME receives an RSSII more than 89.45 %, the OEMs should select such an enterprise as their partners for attaining the sustainability goals. The significance of relative SSII has been enumerated as follows:

1) The parameter SSII determines the relative position of MSMEs for sustainable manufacturing and business operations.

2) It demonstrates a perfect trade off among the core competency, technological development, workforce knowledge and collaborative information sharing for successful implementation of SSCP.
3) It emphasizes the involvement of the management and enterprise for strategic orientation by focussing on an exhaustive roadmap for implementation of policy framework, government regulations, ethical and safe practices as well as attractive wage and incentive systems.
4) It establishes that strong management support, planning for implementation, budgetary provisions and investments, and innovative methods for implementation of SSCPs are key for the long term survival.
5) It emphasizes on collaborative initiatives within MSMEs for customer support, promotion of sustainable production and knowledge sharing. This means the stakeholders must develop a cohesive structure to become responsible and autonomous.

The fifth chapter evaluates the SSCM performance indicators (SPIs) and identifies the ones that are most influential in the context of SSCM. TISM is used to position the indicators into various levels based on their importance and analyse the mutual interactions among them. In the next phase, AHP was used to prioritise these factors on the basis of their relative importance. This chapter evaluates the SPIs and identifies the ones that are most influential in the context of SSCM. In ISM, the SPIs positioned at the bottom level are considered to be the most influential ones and can affect the SPIs above them. With expert opinions, the SPIs in the ISM model were categorised into three sections i.e., most influential, moderately influential and less influential (Gardas et al., 2019). In the first section of the ISM model for the most significant SPIs, four levels from the bottom, which is from level V to level VIII were considered. Government regulations (GR), Business strategies (BS), Enterprise culture (EC), Environment policies and regulations (EP). These SPIs need to be addressed at the top most priority by the decision makers in the enterprises.

In order to measure the driving and dependence power of the SPIs under study, the MICMAC analysis has been conducted. All the 15 SPIs have been segregated into 4 sectors which are Autonomous, Dominated/Dependent, Relay/ Linkage, Dominant/Independent sector. It was observed that there were no SPIs that lied in the Autonomous quadrant. The fourth quadrant which is the dominant one consists of the most significant SPIs with a high driving power and low dependence. This quadrant of indicators can drive all other quadrants and requires to be

addressed at the highest priority by the SC managers. Five SPIs lie in this quadrant and they are Business strategies, Implementation planning and impact on stakeholders, Investments and allocation of budgets, Enterprise culture, Environment policies and regulations and Government regulations. The results from ISM based model and MICMAC analysis are almost similar which highlight a certain set of SPIs as most important and direct the managers to take proactive measures in those fields at a priority basis. In the AHP hierarchical structure, the goal is to evaluate the SPIs and there are three criteria which are creating an implementation environment that has received the lowest priority followed by, developing an implementation culture and implementation of SSCPs received the highest priority by the panel of experts.

5. Managerial Insights and Contributions

A number of managerial implications have been derived from the current research work; some of the important ones from Chapters 3, 4 and 5 have been presented in Table 2.

Table 2. Key Managerial Insights from the research

Chapter No.	Managerial Insights
Chapter 3	• The framework would help the management of Indian SMEs for a quicker analysis regarding the prioritization of implementation inhibitors for SSCP. The preparedness for the sustainability drive can be assessed. • The framework would establish a strategic intent and compatibility among the stakeholders of the SC to initiate strategy development and resource allocation for SSCP. • The framework would use a focus group of decision makers to minimize the subjective bias of the individual decision makers by checking the consistency of the judgments.
Chapter 4	• The managers should consider the SC from a systems perspective to cooperate among all the stakeholders to achieve sustainable SC strategic goals. • The results will help the managers to prioritize the SSCPs by using cause and effect relationships so that they can adequately invest on the top priority practices. • The hybrid approach enables a faster analysis regarding the selection of the compatible MSME by OEMs for a long term relationship. • The current study has focused upon a limited number of CSFs for the implementation of SSCPs in MSMEs, to be considered as a potential candidate for a strategic partnership with OEMs. This would result in developing a generic framework across MSMEs for the strategic relationship with these organizations by considering more CSFs.
Chapter 5	• In order to implement the SSCPs, there is a requirement of an active support from Indian government. • It is difficult for the OEMs to realize benefits of adopting SSCPs unless awareness is created among the

	customers regarding the sustainability initiatives undertaken by the enteprises. • There is a need for most of the automobile component manufacturing MSMEs to incorporate cleaner process technologies that support reuse, recycle and remanufacturing. • The MSMEs require adequate budget allocations and investment capacities to incorporate the sustainable way of production.

The chapter-wise perspectives, characteristics and contributions from the research work have been presented in Table 3.

Table 2. Chapter-wise perspectives, characteristics and contributions

	Chapter 2	**Chapter 3**	**Chapter 4**	**Chapter 5**
Perspectives	The second chapter focusses on reviewing the various perspectives of SSCM based on a thorough literature survey.	This chapter focusses on the identification and subsequent prioritisation of implementation inhibitors for adoption of SSCPs in the MSMEs	The fourth chapter focusses on the identification of critical success factors and understand their interrelationships. Further, to identify the degree of implementation of SSCPs in the MSMEs	The fifth chapter focusses on the identification of SSC performance indicators and analysis of their mutual dependencies.
Characteristics	The existing literature on SSCM can be classified into five specific categories namely, environmental, social, economic, performance assessment and governance mechanism.	The lack of adequate sustainability policies and regulations is of the highest order of importance playing a major role in hindering the adoption of SSCPs. Misalignment of short term and long term goals are affect the adoption of SSCPs	Implementation of policy framework, government regulations, ethical and safe practices as well as attractive wage and incentive systems. This chapter establishes that strong management support, planning for implementation, budgetary provisions and investments, and innovative methods for implementation of SSCPs are key for the long term survival.	Business strategies, implementation planning and impact on stakeholders, investments and budgetary provisions and government policies and regulations are critical indicators for the sustainable performance of the business enterprises.
Contributions	A list of research gaps and insights have been identified which can be potential research directions for the upcoming researchers interested in SSCM.	The relative importance of the implementation inhibitors for managers to understand a step by step method to address the factors based on their priority.	A set of critical success factors which will guide the enterprises to implement the SSCPs. A measurement index for the degree of implementation of SSCPs to determine the relative position of these enterprises.	The classification of the SPIs into clusters based on their mutual dependencies which affect the sustainable performance of enterprises and their priorities.

The quantitative models developed during the research have been summarised in the Table 4 as follows:

Table 4. Quantitative models in research work

Gaps addressed	Modelling approach	Features of the model	Purpose

In order to develop a sustainable enterprise, it is crucial to understand the factors inhibiting the implementation of SSCPs. This gap has been addressed by this model.	Quantitative model (AHP)	• Fifteen critical implementation inhibitors have been identified. • A hierarchical model with three levels i.e., goal, attribute level, sub-attribute level has been developed. • The rank of all the 15 inhibitors based on the priority weights determined through pairwise comparison has been identified. • A post optimality test has been performed to determine the range of the priority weights of the inhibitors	The purpose of this study was to identify and then prioritize the implementation inhibitors for the SSCPs.
The success of an enterprise can be determined if there is a technique to identify the degree of implementation of SSCPs. The OEMs would be interested in the relative positioning of the enterprises based on their CSFs for adoption of SSCPs.	Quantitative model (ANP-FL)	• A set of fifteen critical success factors (CSFs) have been identified. • A network of the CSFs has been developed considering their mutual dependencies. • Fuzzy logic modelling has been used to generate a measurement index for assessing the degree of implementation of SSCPs in MSMEs.	The purpose of this study was to understand the relative positioning of the enterprises based on their implementation of SSCPs which will in turn provide a basis for OEMs to develop a strategic collaboration with the MSMEs.
The performance indicators will help in understanding the implementation of the SSCPs in the enterprises.	Quantitative model (T-WISM AHP)	• A set of SSC performance indicators (SPIs) have been identified. • Effective index of the SPIs has been calculated using Weighted-ISM. • The mutual interactions of the indicators have been established. • The SPIs have been prioritised using AHP.	The purpose of this study was to identify the sustainable performance indicators and rank them in the order of their importance which will provide an understanding of the level of performance of the enterprises after the implementation of the SSCPs.

The following section highlights the concluding remarks of the research work including the research limitations and future scope of the present study.

6. Concluding Remarks

The automobile industry is considered to be the ‘Industry of Industries’ as it uses products from most of the manufacturing industries and supports both upstream and downstream industries (Bhattacharya et al., 2014). This sector is an asset, also material and labor intensive which requires strategic planning at all levels of the SC.

Currently, the automobile manufacturers are yet to make adequate usage of the SSCPs. Owing to the large scale government interventions for sustainability, the automobile

component manufacturing MSMEs yearn to adopt the sustainable practices into their SCs. This research work will help the managers in these enterprises to understand the implementation inhibitors which hinder the adoption of SSCPs. Further, a list of critical success factors which will facilitate the successful implementation of SSCPs in the enterprises has been derived which will be useful to the managers. This research will also provide the OEMs to identify the MSMEs with which they would be interested in a strategic collaboration based on their relative positioning in adoption of SSCPs. The sustainable performance of these enterprises can also be assessed by considering the key indicators presented in this study.

The major limitation of this research work lies in applying the quantitative and analytical modeling approaches in cross enterprise or industry and cross country scenarios. The analytical modeling may be extended by relaxing some of the assumptions for better results.

The automobile MSME SC is a multi-tier and complex network which is driven by stakeholders' (governments, investors, consumers, employees, contemporaries). Very little research has been done in the literature to identify the stakeholder requirements. Further, the automobile MSME SCs must enhance their responsiveness towards the varying stakeholder demands owing to the latest trends, schemes and regulations. Another interesting area for future research is exploring the effect of stakeholder requirements on the relationship at different layers in the SC which has not been conducted with great details.

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